



# University of Pretoria Yearbook 2020

## BCom Statistics and Data Science (07130263)

<b>Minimum duration of study</b>	3 years
<b>Total credits</b>	398
<b>NQF level</b>	07
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### Programme information

Statistics is an independent discipline with interdisciplinary applications. The aim of this qualification is to prepare the candidates in totality with methods that can be applied for the gathering and interpretation of data and empirical information. Statistics lay the foundation for scientific accountable conclusions, planning and estimation. Candidates are equipped detailed computer and communication skills throughout the course. Statistics is commissioned by all disciplines where it can contribute towards scientific and technological progress, most notably in data science. This qualification trains a statistician to work in a data science environment.

### Additional requirements

- General Regulations G.1 to G.15 (with the exception of Regulation G.11.2(c)) apply to a bachelor's degree.
- A student may not take more than the prescribed number of modules per semester unless the Dean decides otherwise.
- A student may take a module not listed as an elective module only if the prior approval of the Dean has been obtained.
- A student who is in possession of a bachelor's degree may not present any modules passed for that degree for another field of specialisation or degree in this Faculty. (See General Regulations G.8 and G.9)
- A module already passed may only be repeated with the approval of the Dean.
- A module passed may not be taken into account for more than one degree or field of specialisation.
- It remains the student's responsibility to ascertain, prior to registration, whether all the modules he/she intends taking can be accommodated in the class, test and examination timetables.
- The Faculty of Economic and Management Sciences supports an outcomes-based education system and places a high premium on the development of specific academic competences. Class attendance in all modules and for the full duration of all programmes is therefore compulsory for all students.
- The Dean has the right of authorisation regarding matters not provided for in the General Regulations or the Faculty Regulations.

### Other programme-specific information

- Total credits refer to minimum as required by the programme, but can be more, depending on the elective modules.
- The only WST module that students are allowed to take along with the STK modules is WST212. The only STK



modules that students are allowed to take along with the WST modules are STK320 and STK353.

- Alternative credits as indicated in brackets are based on choosing WST as a specialisation module instead of STK, while all elective modules are selected within the Faculty of Economic and Management Sciences.
- Only two 14-week modules on the 300-level, or the equivalent thereof, that are not preceded by the 100- and 200-level modules, may be taken for degree purposes. In other words, at least four 14-week modules must be taken at 300-level that are preceded by the 100- and 200-level apart from the modules offered only at 200- and 300-level.
- The number of elective modules is influenced by the inclusion of modules from other faculties and their respective credit values.

### **With regard to choosing elective modules:**

It is recommended that COS 132 be taken as an elective by all students in this programme. Students can then follow one of the following elective options depending on their specific career requirements. Other options are possible subject to consultation with and approval by the programme coordinator.

1. Mathematical Statistics option with major WST111, WST121, WST211, WST221, WST212, WST311, WST312, (WST321 or STK320), STK 353:

Year 1: WTW 114 (16), WTW 124 (16)

Year 2: WTW 211 (12), WTW 218 (12) and WTW 220 (12), WTW 221 (12), WTW 264 (12), WTW 248 (12) or three from EKN 214 (16), EKN 234 (16), EKN 224 (16), EKN 244 (16)

Year 3: Choose three from WTW 310 (18), WTW 382 (18), WTW 354 (18), WTW 364 (18), WTW 381 (18), WTW 389 (18), WTW 320 (18), WST322 (18), EKN 310 (20), EKN 314 (20), EKN 320 (20), EKN 325 (20).

2. Mathematics option with major STK 110, STC 122, STK 210, STK 220, WST212, STK 310, STK 320, STK 353:

Year 1: WTW 114 (16), WTW 124 (16)

Year 2: WTW 218 (12), WTW 211 (12), WTW 220 (12), WTW 221 (12), WTW 264 (12), WTW 248 (12)

Year 3: Choose four from WTW 310 (18), WTW 382 (18), WTW 381 (18), WTW 389 (18), WTW 320 (18)

3. Economics option with major STK 110, STC 122, STK 210, STK 220, WST212, STK 310, STK 320, STK 353:

Year 1: COS 132 (16), COS 122 (16) or INF 154 (10), INF 164 (10), INF 171 (20)

Year 2: EKN 214 (16), EKN 234 (16), EKN 224 (16), EKN 244 (16), INF 261 (7), INF 264 (8)

Year 3: Choose three from EKN 310 (20), EKN 314 (20), EKN 320 (20), EKN 325 (20)

4. Informatics option with major STK 110, STC 122, STK 210, STK 220, WST212, STK 310, STK 320, STK 353:

Year 1: INF 154 (10), INF 164 (10), INF 171 (20)

Year 2: INF 272 (16), INF 225 (14), INF 261 (14), INF 214 (14), INF 271 (14)

Year 3: Choose 65 credits from INF 315 (15), INF 324 (15), INF 354 (15), INF 370 (35)

**Note:** Please refer to the individual modules for prerequisites.

At least one of the two elective modules in which a candidate graduate must be selected from the available modules within the Economics and Management Sciences Faculty.

FRK 122 is a terminating module. Candidates will not be able to continue with financial accounting in the second or third year. A student cannot get credits for both FRK 121 and FRK 122.

**Specialisation modules:** WST 212, STK 310, 320, 353 or WST 212, 311, 312, 321, STK 353.

"Major subject"

To be considered a "major subject" the equivalent of four 14-week modules, including two at 300-level, must be passed provided that:

- a module passed at 300-level shall only be recognised for degree purposes if the corresponding prescribed module(s) at 200-level has/have been passed, unless the Dean decides otherwise;



- the following modules which are offered at 300-level only, are also considered "major subjects": Labour law 311 (ABR 311), Labour relations 320 (ABV 320), and International business management 359 and 369 (OBS 359 and 369); and
- only two 14-week modules, or the equivalent thereof, that are not preceded by the 100- and 200-level modules, may be taken for degree purposes. In other words, at least four 14-week modules must be taken at 300-level that are preceded by the 100- and 200-level, except for modules offered on 200- and 300-level only.

It is thus the responsibility of students to ensure before registration, that their curricula comply with all the requirements of the applicable regulations.

## Promotion to next study year

*According to General Regulation G.3 students have to comply with certain requirements as set by the Faculty Board.*

- a. A student must pass at least 4 core semester or 2 core year modules to be admitted to the subsequent year of study.
- b. If a student has passed less than the required minimum of 4 core semester or 2 core year modules, he/she will not be readmitted to the Faculty of Economic and Management Sciences. Such a student may apply in writing to the Faculty's Admissions Committee to be readmitted conditionally – with the proviso that the Admissions Committee may set further conditions with regards to the student's academic progress. The Faculty's Admissions Committee may deny a student's application for readmission.
- c. If a student has been readmitted conditionally, his/her academic progress will be monitored after the first semester examinations to determine whether he/she has complied with the requirements set by the Admissions Committee. If not, his/her studies will be suspended.
- d. A student whose studies have been suspended because of his/her poor academic performance has the right to appeal against the decision of the Faculty's Admissions Committee.
- e. A student may be refused promotion to a subsequent year of study if the prescribed tuition fees are not paid.
- f. A student may be refused admission to the examination, or promotion to a subsequent year of study or promotion in a module (if applicable) if he/ she fails to fulfil the attendance requirements. Class attendance in all modules and for the full duration of all programmes is compulsory for all students.

## Pass with distinction

- a. A degree may be awarded with distinction provided the candidate meets the following criteria:
  - i. Completes the degree within three years;
  - ii. Obtains a Cumulative Grade Point Average (CGPA) of 75%;
  - iii. Repeated passed modules will not be considered. The initial pass mark of module will be used when calculating the GPA.
- b. A degree will only be awarded with distinction to transferees from other degrees in the Faculty of Economic and Management Sciences, other faculties and from other universities who still complete their bachelor degrees within three years (including the years registered for the other degree and credits transferred and recognised).
- c. The GPA will be not be rounded up to a whole number.
- d. Exceptional cases will be considered by the Dean.



## General information

### **Minimum requirements for bachelor's degrees; semester and year modules; new regulations**

1. Students who commenced their studies before 2015 must complete the programme in terms of the curriculum of the year in which they commenced their studies, or in terms of the curriculum of the year in which they switched to their current field of specialisation. Students who prefer to do so may, however, apply to change over to the latest curriculum, but then they should comply with all the requirements thereof and they may not revert to the regulations of an earlier year.
2. Students who are registering for a degree programme for the first time from 2015 onward must take the modules indicated under the particular field of specialisation.



## Curriculum: Year 1

Minimum credits: 134

### Fundamental modules

#### Academic information management 111 (AIM 111)

**Module credits** 4.00

**Service modules**

Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Economic and Management Sciences  
Faculty of Humanities  
Faculty of Law  
Faculty of Health Sciences  
Faculty of Natural and Agricultural Sciences  
Faculty of Theology and Religion

**Prerequisites** No prerequisites.

**Contact time** 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Information Science

**Period of presentation** Semester 1

**Module content**

Find, evaluate, process, manage and present information resources for academic purposes using appropriate technology.

#### Academic information management 121 (AIM 121)

**Module credits** 4.00

**Service modules**

Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Economic and Management Sciences  
Faculty of Humanities  
Faculty of Law  
Faculty of Health Sciences  
Faculty of Natural and Agricultural Sciences  
Faculty of Theology and Religion  
Faculty of Veterinary Science

**Prerequisites** No prerequisites.

**Contact time** 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Informatics

**Period of presentation** Semester 2



### Module content

Apply effective search strategies in different technological environments. Demonstrate the ethical and fair use of information resources. Integrate 21st-century communications into the management of academic information.

## Academic literacy for Economic and Management Sciences 124 (ALL 124)

**Module credits** 6.00

**Service modules** Faculty of Economic and Management Sciences

**Prerequisites** No prerequisites.

**Contact time** 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Unit for Academic Literacy

**Period of presentation** Semester 1 and Semester 2

### Module content

This module is intended to equip students with the competence in reading and writing required in the four high impact modules: Business Management, Financial Accounting, Statistics and Economics. Students will also be equipped to interpret and draw figures and graphs and to do computations and manage relevant formulas. Students attend two lectures per week during semester two.

*This module is offered by the Faculty of Humanities.*

## Academic orientation 107 (UPO 107)

**Module credits** 0.00

**Language of tuition** Module is presented in English

**Department** Economic and Management Sciences Deans Office

**Period of presentation** Year

## Core modules

### Economics 110 (EKN 110)

**Module credits** 10.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Humanities  
Faculty of Natural and Agricultural Sciences

**Prerequisites** No prerequisites.

**Contact time** 1 discussion class per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Economics



**Period of presentation** Semester 1

### Module content

This module deals with the core principles of economics. A distinction between macroeconomics and microeconomics is made. A discussion of the market system and circular flow of goods, services and money is followed by a section dealing with microeconomic principles, including demand and supply analysis, consumer behaviour and utility maximisation, production and the costs thereof, and the different market models and firm behaviour. Labour market institutions and issues, wage determination, as well as income inequality and poverty are also addressed. A section of money, banking, interest rates and monetary policy concludes the course.

## Economics 120 (EKN 120)

**Module credits** 10.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Humanities  
Faculty of Natural and Agricultural Sciences

**Prerequisites** EKN 110 GS or EKN 113 GS and at least 4 (50-59%) in Mathematics in the Grade 12 examination or 60% in STK 113 and concurrently registered for STK 123

**Contact time** 1 discussion class per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Economics

**Period of presentation** Semester 2

### Module content

This module deals with the core principles of economics, especially macroeconomic measurement the private and public sectors of the South African economy receive attention, while basic macroeconomic relationships and the measurement of domestic output and national income are discussed. Aggregate demand and supply analysis stands core to this course which is also used to introduce students to the analysis of economic growth, unemployment and inflation. The microeconomics of government is addressed in a separate section, followed by a section on international economics, focusing on international trade, exchange rates and the balance of payments. The economics of developing countries and South Africa in the global economy conclude the course.

## Financial accounting 111 (FRK 111)

**Module credits** 10.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Law  
Faculty of Natural and Agricultural Sciences

**Prerequisites** No prerequisites.

**Contact time** 4 lectures per week

**Language of tuition** Module is presented in English

**Department** Accounting



**Period of presentation** Semester 1

### Module content

The nature and function of accounting; the development of accounting; financial position; financial result; the recording process; processing of accounting data; treatment of VAT; elementary income statement and balance sheet; flow of documents; accounting systems; introduction to internal control and internal control measures; bank reconciliations; control accounts; adjustments; financial statements of a sole proprietorship; the accounting framework.

## Financial accounting 121 (FRK 121)

**Module credits** 12.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Natural and Agricultural Sciences

**Prerequisites** FRK 111 GS

**Contact time** 4 lectures per week

**Language of tuition** Module is presented in English

**Department** Accounting

**Period of presentation** Semester 2

### Module content

Property, plant and equipment; intangible assets; inventories; liabilities; presentation of financial statements; enterprises without profit motive; partnerships; companies; close corporations; cash flow statements; analysis and interpretation of financial statements.

## Financial accounting 122 (FRK 122)

**Module credits** 12.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Law  
Faculty of Natural and Agricultural Sciences

**Prerequisites** FRK 111 GS or FRK 133, FRK 143

**Contact time** 4 lectures per week

**Language of tuition** Module is presented in English

**Department** Accounting

**Period of presentation** Semester 2

### Module content

Budgeting, payroll accounting, taxation – income tax and an introduction to other types of taxes, credit and the new Credit Act, insurance, accounting for inventories (focus on inventory and the accounting entries, not calculations), interpretation of financial statements.





## Informatics 183 (INF 183)

<b>Module credits</b>	3.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 practical per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Informatics
<b>Period of presentation</b>	Year

### Module content

Computer processing of accounting information.

## Business management 114 (OBS 114)

<b>Module credits</b>	10.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	May not be included in the same curriculum as OBS 155
<b>Contact time</b>	3 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Business Management
<b>Period of presentation</b>	Semester 1

### Module content

The entrepreneurial mind-set; managers and managing; values, attitudes, emotions, and culture: the manager as a person; ethics and social responsibility; decision making; leadership and responsible leadership; effective groups and teams; managing organizational structure and culture inclusive of the different functions of a generic organisation and how they interact (marketing; finance; operations; human resources and general management); contextualising Sustainable Development Goals (SDG) in each of the topics.

## Business management 124 (OBS 124)

<b>Module credits</b>	10.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	Admission to the examination in OBS 114
<b>Contact time</b>	3 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Business Management



**Period of presentation** Semester 2

### Module content

Value chain management: functional strategies for competitive advantage; human resource management; managing diverse employees in a multicultural environment; motivation and performance; using advanced information technology to increase performance; production and operations management; financial management; corporate entrepreneurship.

## Statistics 122 (STC 122)

**Module credits** 13.00

### Prerequisites

At least a 60% in STK 110 or an average of 60% for either (1) WST 133, WST 143, WST 153; (2) STK 113, STK 123, STK 121; (3) STK 133, STK 134, STK121; (4) WST 133, WST 143, STK 121 (An aegrotat exam is available to students who obtained 50%-59%)

### Contact time

1 practical per week, 1 tutorial per week, 3 lectures per week

### Language of tuition

Module is presented in English

### Department

Statistics

### Period of presentation

Semester 2

### Module content

Inferential concepts. Experimental and observational data. Measures of association, uncertainty and goodness of fit. Sampling error and accuracy of estimation. Introduction to linear regression, reduction of variation due to regression. Conditional distributions of residuals. Simulation based inference: conditional means and prediction intervals. Bivariate data visualisation. Supporting mathematical concepts. Statistical concepts are demonstrated and interpreted through practical coding and simulation within a data science framework.

*This module is also presented as a summer school for students who initially elected and passed STK 120 with a final mark of at least 60% and then decides to further their studies in statistics as well as for students who achieved a final mark of between 40% - 49% in STC 122 during semester 2.*

## Statistics 110 (STK 110)

**Module credits** 13.00

### Service modules

Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Humanities  
Faculty of Natural and Agricultural Sciences

### Prerequisites

At least 5 (60-69%) in Mathematics in the Grade 12 examination. Candidates who do not qualify for STK 110 must register for STK 113 and STK 123

### Contact time

1 practical per week, 1 tutorial per week, 3 lectures per week

### Language of tuition

Module is presented in English

### Department

Statistics

### Period of presentation

Semester 1



## Module content

Descriptive statistics:

Sampling and the collection of data; frequency distributions and graphical representations. Descriptive measures of location and dispersion.

Probability and inference:

Introductory probability theory and theoretical distributions. Sampling distributions. Estimation theory and hypothesis testing of sampling averages and proportions (one and two-sample cases). Supporting mathematical concepts. Statistical concepts are demonstrated and interpreted through practical coding and simulation within a data science framework.

## Mathematical statistics 111 (WST 111)

**Module credits** 16.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Economic and Management Sciences  
Faculty of Natural and Agricultural Sciences

**Prerequisites** At least 5 (60-69%) in Mathematics in the Grade 12 examination

**Contact time** 1 practical per week, 4 lectures per week

**Language of tuition** Module is presented in English

**Department** Statistics

**Period of presentation** Semester 1

## Module content

Characterisation of a set of measurements: Graphical and numerical methods. Random sampling. Probability theory. Discrete and continuous random variables. Probability distributions. Generating functions and moments.

## Mathematical statistics 121 (WST 121)

**Module credits** 16.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Economic and Management Sciences  
Faculty of Natural and Agricultural Sciences

**Prerequisites** WST 111 GS or WST 133, 143 and 153

**Contact time** 1 practical per week, 4 lectures per week

**Language of tuition** Module is presented in English

**Department** Statistics

**Period of presentation** Semester 2

## Module content

Sampling distributions and the central limit theorem. Statistical inference: Point and interval estimation. Hypothesis testing with applications in one and two-sample cases. Introductory methods for: Linear regression and correlation, analysis of variance, categorical data analysis and non-parametric statistics. Identification, use, evaluation and interpretation of statistical computer packages and statistical techniques.



## Elective modules

### Operating systems 122 (COS 122)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	COS 132
<b>Contact time</b>	1 practical per week, 1 tutorial per week, 3 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Computer Science
<b>Period of presentation</b>	Semester 2

#### Module content

Fundamental concepts of modern operating systems in terms of their structure and the mechanisms they use are studied in this module. After completing this module, students will have gained, as outcomes, knowledge of real time, multimedia and multiple processor systems, as these will be defined and analysed. In addition, students will have gained knowledge on modern design issues of process management, deadlock and concurrency control, memory management, input/output management, file systems and operating system security. In order to experience a hands-on approach to the knowledge students would have gained from studying the abovementioned concepts, students will have produced a number of practical implementations of these concepts using the Windows and Linux operating systems.

### Imperative programming 132 (COS 132)

<b>Module credits</b>	16.00
<b>Service modules</b>	Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	APS of 30 and level 5 (60-69%) Mathematics
<b>Contact time</b>	1 practical per week, 1 tutorial per week, 3 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Computer Science
<b>Period of presentation</b>	Semester 1

#### Module content

This module introduces imperative computer programming, which is a fundamental building block of computer science. The process of constructing a program for solving a given problem, of editing it, compiling (both manually and automatically), running and debugging it, is covered from the beginning. The aim is to master the elements of a programming language and be able to put them together in order to construct programs using types, control structures, arrays, functions and libraries. An introduction to object orientation will be given. After completing this module, the student should understand the fundamental elements of a program, the importance of good program design and user-friendly interfaces. Students should be able to conduct basic program analysis and write complete elementary programs.

### Financial management 112 (FBS 112)

<b>Module credits</b>	10.00
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**Service modules** Faculty of Natural and Agricultural Sciences

**Prerequisites** At least 6 (70-79%) in Mathematics in the Grade 12 examination or WTW 133 (60%), WTW 143 (60%), WST 133 (60%) and WST 143 (60%).

**Contact time** 3 lectures per week

**Language of tuition** Module is presented in English

**Department** Financial Management

**Period of presentation** Semester 1

### Module content

\*Only for students in BSc (Actuarial and Financial Mathematics), BSc (Mathematics), BSc (Applied Mathematics), BSc (Mathematical Statistics), BSc Extended programme – Mathematical Sciences and BCom (Statistics) who comply with the set prerequisites.

Key principles of financial management. Company ownership. Taxation. Introduction to financial statements. Structure of financial statements. Depreciation and reserves. Preparing financial statements. Group financial statements and insurance company financial statements. Interpretation of financial statements. Limitation of financial statements. Issue of share capital.

## Financial management 122 (FBS 122)

**Module credits** 10.00

**Service modules** Faculty of Natural and Agricultural Sciences

**Prerequisites** FBS 112 or WST 121 and 07130261 or 07130262 or 02133388 or 02133273 or 02133395 or 02133274 or 02130007 or 02130016

**Contact time** 3 lectures per week

**Language of tuition** Module is presented in English

**Department** Financial Management

**Period of presentation** Semester 2

### Module content

Financial instruments. Use of financial derivatives. Financial institutions. Time value of money. Component cost of capital. Weighted average cost of capital. Capital structure and dividend policy. Capital project appraisal. Evaluating risky investments.

## Informatics 112 (INF 112)

**Module credits** 10.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Natural and Agricultural Sciences

**Prerequisites** A candidate must have passed Mathematics with at least 4 (50-59%) in the Grade 12 examination; or STK 113 60%, STK 123 60% or STK 110

**Contact time** 2 lectures per week



**Language of tuition** Module is presented in English

**Department** Informatics

**Period of presentation** Semester 2

### Module content

Introduction to information systems, information systems in organisations, hardware: input, processing, output, software: systems and application software, organisation of data and information, telecommunications and networks, the Internet and Intranet. Transaction processing systems, management information systems, decision support systems, information systems in business and society, systems analysis, systems design, implementation, maintenance and revision.

## Informatics 154 (INF 154)

**Module credits** 10.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Natural and Agricultural Sciences

**Prerequisites** A candidate must have passed Mathematics with at least 4 (50-59%) in the Grade 12 examination

**Contact time** 1 lecture per week, 2 practicals per week

**Language of tuition** Module is presented in English

**Department** Informatics

**Period of presentation** Semester 1

### Module content

Introduction to programming.

## Informatics 164 (INF 164)

**Module credits** 10.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Natural and Agricultural Sciences

**Prerequisites** INF 154; A candidate must have passed Mathematics with at least 4 (50-59%) in the Grade 12 examination; AIM 101 or AIM 102 or AIM 111 and AIM 121

**Contact time** 1 lecture per week, 2 practicals per week

**Language of tuition** Module is presented in English

**Department** Informatics

**Period of presentation** Semester 2

### Module content

Programming.

## Informatics 171 (INF 171)

**Module credits** 20.00



<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	A candidate must have passed Mathematics with at least 4 (50-59%) in the Grade 12 examination
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Informatics
<b>Period of presentation</b>	Year

#### Module content

General systems theory, creative problem solving, soft systems methodology. The systems analyst, systems development building blocks, systems development, systems analysis methods, process modelling.

### Calculus 114 (WTW 114)

<b>Module credits</b>	16.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities
<b>Prerequisites</b>	60% for Mathematics in Grade 12
<b>Contact time</b>	1 tutorial per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Mathematics and Applied Mathematics
<b>Period of presentation</b>	Semester 1

#### Module content

\*This module serves as preparation for students majoring in Mathematics (including all students who intend to enrol for WTW 218 and WTW 220). Students will not be credited for more than one of the following modules for their degree: WTW 114, WTW 158, WTW 134, WTW 165.

Functions, limits and continuity. Differential calculus of single variable functions, rate of change, graph sketching, applications. The mean value theorem, the rule of L'Hospital. Definite and indefinite integrals, evaluating definite integrals using anti-derivatives, the substitution rule.

### Mathematics 124 (WTW 124)

<b>Module credits</b>	16.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences
<b>Prerequisites</b>	WTW 114
<b>Contact time</b>	1 tutorial per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English



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**Department** Mathematics and Applied Mathematics

**Period of presentation** Semester 2

**Module content**

\*Students will not be credited for more than one of the following modules for their degree:

WTW 124, WTW 146, WTW 148 and WTW 164. This module serves as preparation for students majoring in Mathematics (including all students who intend to enrol for WTW 218, WTW 211 and WTW 220).

The vector space  $R^n$ , vector algebra with applications to lines and planes, matrix algebra, systems of linear equations, determinants. Complex numbers and factorisation of polynomials. Integration techniques and applications of integration. The formal definition of a limit. The fundamental theorem of Calculus and applications. Vector functions and quadratic curves.





## Curriculum: Year 2

Minimum credits: 129

### Core modules

#### Communication management 282 (KOB 282)

**Module credits** 5.00

**Contact time** 3 lectures per week

**Language of tuition** Module is presented in English

**Department** Business Management

**Period of presentation** Quarter 2

#### Module content

\*Module content will be adapted in accordance with the appropriate degree programme. Only one of KOB 281–284 may be taken as a module where necessary for a programme.

Applied business communication skills

Acquiring basic business communication skills will enhance the capabilities of employees, managers and leaders in the business environment. An overview of applied skills on the intrapersonal, dyadic, interpersonal, group (team), organisational, public and mass communication contexts is provided. The practical part of the module (for example, the writing of business reports and presentation skills) concentrates on the performance dimensions of these skills as applied to particular professions.

#### Statistics 210 (STK 210)

**Module credits** 20.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Humanities  
Faculty of Natural and Agricultural Sciences

**Prerequisites** STK 110, STC 122 or WST 111, WST 121

**Contact time** 1 practical per week, 3 lectures per week

**Language of tuition** Module is presented in English

**Department** Statistics

**Period of presentation** Semester 1

#### Module content

Statistical problem solving. Causality, experimental and observational data. Probability theory. Multivariate random variables. Discrete and continuous probability distributions. Stochastic representations. Measures of association. Expected values and conditional expectation. Simulation techniques. Supporting mathematical concepts. Statistical concepts are demonstrated and interpreted through practical coding and simulation within a data science framework.

#### Statistics 220 (STK 220)



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<b>Module credits</b>	20.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Humanities Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	STK 210 GS
<b>Contact time</b>	1 practical per week, 3 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Statistics
<b>Period of presentation</b>	Semester 2

### Module content

Multivariate probability distributions. Sampling distributions and the central limit theorem. Frequentist and Bayesian inference. Statistical learning and decision theory. Simulation techniques enhancing statistical thinking. Supervised learning: linear regression, estimation and inference. Non-parametric modelling. Supporting mathematical concepts. Statistical algorithms. Statistical concepts are demonstrated and interpreted through practical coding and simulation within a data science framework.

## Mathematical statistics 211 (WST 211)

<b>Module credits</b>	24.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	WST 111, WST 121, WTW 114 GS and WTW 124 GS
<b>Contact time</b>	2 practicals per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Statistics
<b>Period of presentation</b>	Semester 1

### Module content

Set theory. Probability measure functions. Random variables. Distribution functions. Probability mass functions. Density functions. Expected values. Moments. Moment generating functions. Special probability distributions: Bernoulli, binomial, hypergeometric, geometric, negative binomial, Poisson, Poisson process, discrete uniform, uniform, gamma, exponential, Weibull, Pareto, normal. Joint distributions: Multinomial, extended hypergeometric, joint continuous distributions. Marginal distributions. Independent random variables. Conditional distributions. Covariance, correlation. Conditional expected values. Transformation of random variables: Convolution formula. Order statistics. Stochastic convergence: Convergence in distribution. Central limit theorem. Practical applications. Practical statistical modelling and analysis using statistical computer packages and the interpretation of the output.

## Applications in data science 212 (WST 212)

<b>Module credits</b>	12.00
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**Prerequisites** WST 111, WST 121 or STK 110, STC 122

**Contact time** 1 practical per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Statistics

**Period of presentation** Semester 1

### Module content

Introductory machine learning concepts. Data base design and use. Data preparation and extraction. Statistical modelling using data base structures. Statistical concepts are demonstrated and interpreted through practical coding and simulation within a data science framework.

## Mathematical statistics 221 (WST 221)

**Module credits** 24.00

**Service modules** Faculty of Natural and Agricultural Sciences

**Prerequisites** WST 211 GS

**Contact time** 2 practicals per week, 4 lectures per week

**Language of tuition** Module is presented in English

**Department** Statistics

**Period of presentation** Semester 2

### Module content

Stochastic convergence: Asymptotic normal distributions, convergence in probability. Statistics and sampling distributions: Chi-squared distribution. Distribution of the sample mean and sample variance for random samples from a normal population. T-distribution. F-distribution. Beta distribution. Point estimation: Method of moments. Maximum likelihood estimation. Unbiased estimators. Uniform minimum variance unbiased estimators. Cramer-Rao inequality. Efficiency. Consistency. Asymptotic relative efficiency. Bayes estimators. Sufficient statistics. Completeness. The exponential class. Confidence intervals. Test of statistical hypotheses. Reliability and survival distributions. Practical applications. Practical statistical modelling and analysis using statistical computer packages and the interpretation of the output.

## Elective modules

### Economics 214 (EKN 214)

**Module credits** 16.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Humanities  
Faculty of Natural and Agricultural Sciences

**Prerequisites** EKN 110 GS & EKN 120 OR EKN 113 GS & EKN 123; & STK 110 GS OR STK 113 & STK 123 & STK 120/121 or concurrently registered for STK 120/121 OR WST 111 & WST121 are prerequisites instead of STK 120/121 or WST 111 and concurrently registered for WST 121.



**Contact time** 3 lectures per week

**Language of tuition** Module is presented in English

**Department** Economics

**Period of presentation** Semester 1

### Module content

Macroeconomics

From Wall and Bay Street to Diagonal Street: a thorough understanding of the mechanisms and theories explaining the workings of the economy is essential. Macroeconomic insight is provided on the real market, the money market, two market equilibrium, monetarism, growth theory, cyclical analysis, inflation, Keynesian general equilibrium analysis and fiscal and monetary policy issues.

## Economics 224 (EKN 224)

**Module credits** 16.00

**Service modules** Faculty of Education  
Faculty of Humanities  
Faculty of Natural and Agricultural Sciences

**Prerequisites** EKN 110 GS & EKN 120 OR EKN 113 GS & EKN 123; & STK 110 GS OR STK 113 & STK 123 & STK 120/121 or concurrently registered for STK120/121 OR WST 111 & WST121 are prerequisites instead of STK 120/121 or WST 111 and concurrently registered for WST 121.

**Contact time** 3 lectures per week

**Language of tuition** Module is presented in English

**Department** Economics

**Period of presentation** Semester 1

### Module content

Microeconomics

Microeconomic insight is provided into: consumer and producer theory, general microeconomic equilibrium, Pareto-optimality and optimality of the price mechanism, welfare economics, market forms and the production structure of South Africa. Statistic and econometric analysis of microeconomic issues.

## Economics 234 (EKN 234)

**Module credits** 16.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Humanities  
Faculty of Natural and Agricultural Sciences

**Prerequisites** EKN 214 and STK 120/121 or WST 121 OR concurrently registered for STK 120/121 or WST 121.

**Contact time** 3 lectures per week

**Language of tuition** Module is presented in English



**Department** Economics

**Period of presentation** Semester 2

### Module content

Macroeconomics

Application of the principles learned in EKN 214 on the world we live in. We look at international markets and dynamic macroeconomic models, and familiarise the students with the current macroeconomic policy debates. We also take a look at the latest macroeconomic research in the world. The course includes topics of the mathematical and econometric analysis of macroeconomic issues.

## Economics 244 (EKN 244)

**Module credits** 16.00

**Service modules** Faculty of Humanities  
Faculty of Natural and Agricultural Sciences

**Prerequisites** EKN 224 and STK 120/121 or WST 121 OR concurrently registered for STK 120/121 or WST 121.

**Contact time** 3 lectures per week

**Language of tuition** Module is presented in English

**Department** Economics

**Period of presentation** Semester 2

### Module content

Microeconomics

From general equilibrium and economic welfare to uncertainty and asymmetric information. In this module we apply the principles learned in EKN 224 on the world around us by looking at the microeconomic principles of labour and capital markets, as well as reasons why the free market system could fail. We touch on the government's role in market failures. The course includes topics of the mathematical and econometric analysis of microeconomic issues.

## Introduction to moral and political philosophy 251 (FIL 251)

**Module credits** 10.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Economic and Management Sciences

**Prerequisites** No prerequisites.

**Contact time** 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Philosophy

**Period of presentation** Quarter 2, 3 and 4



## Module content

In this module students are equipped with an understanding of the moral issues influencing human agency in economic and political contexts. In particular philosophy equips students with analytical reasoning skills necessary to understand and solve complex moral problems related to economic and political decision making. We demonstrate to students how the biggest questions concerning the socio-economic aspects of our lives can be broken down and illuminated through reasoned debate. Examples of themes which may be covered in the module include justice and the common good, a moral consideration of the nature and role of economic markets on society, issues concerning justice and equality, and dilemmas of loyalty. The works of philosophers covered may for instance include that of Aristotle, Locke, Bentham, Mill, Kant, Rawls, Friedman, Nozick, Bernstein, Dworkin, Sandel, Walzer, and MacIntyre.

## Financial accounting 211 (FRK 211)

**Module credits** 16.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education

**Prerequisites** FRK 111 and FRK 121 or FRK 100/101

**Contact time** 4 lectures per week

**Language of tuition** Module is presented in English

**Department** Accounting

**Period of presentation** Semester 1

## Module content

Preparation and presentation of company annual financial statements in compliance with the requirements of the Companies Act, the Framework and Statements of Generally Accepted Accounting Practice relating to the following: presentation of financial statements; revenue; investments; provisions, contingent liabilities and contingent assets; events after the balance sheet date; inventories; income taxes; leases; property, plant and equipment; impairment of assets; intangible assets; investment property, changes in accounting estimates and errors; introduction to financial instruments.

## Financial accounting 221 (FRK 221)

**Module credits** 16.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education

**Prerequisites** FRK 211 GS

**Contact time** 4 lectures per week

**Language of tuition** Module is presented in English

**Department** Accounting

**Period of presentation** Semester 2



## Module content

Preparation and presentation of company annual financial statements in compliance with the requirements of Statements of Generally Accepted Accounting Practice relating to the following: employee benefits; the effects of changes in foreign exchange rates; accounting policies; earnings per share; cash flow statements; interests in joint ventures. Branch accounting. Introduction to consolidations, including basic consolidation techniques for both wholly-owned and partly-owned subsidiaries. Introduction to public sector accounting.

### Financial mathematics 211 (IAS 211)

<b>Module credits</b>	12.00
<b>Service modules</b>	Faculty of Economic and Management Sciences
<b>Prerequisites</b>	IAS 111, IAS 121, WTW 114, WTW 123, WTW 124, WTW 152, WST 111, WST 121
<b>Contact time</b>	1 practical per week, 3 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Actuarial Science
<b>Period of presentation</b>	Semester 1

## Module content

Principles of actuarial modelling, cash-flow models, the time value of money, interest rates, discounting and accumulating, level annuities, deferred and increasing annuities, equations of value.

### Financial mathematics 282 (IAS 282)

<b>Module credits</b>	12.00
<b>Service modules</b>	Faculty of Economic and Management Sciences
<b>Prerequisites</b>	IAS 211
<b>Contact time</b>	1 practical per week, 3 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Actuarial Science
<b>Period of presentation</b>	Semester 2

## Module content

Principles of actuarial modelling, cash-flow models, the time value of money, interest rates, discounting and accumulating, level annuities, deferred and increasing annuities, equations of value, loan schedules, project appraisal, elementary compound interest problems, term structure of interest rates.

### Informatics 214 (INF 214)

<b>Module credits</b>	14.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	AIM 101 or AIM 111 and AIM 121
<b>Contact time</b>	2 lectures per week, 2 practicals per week



**Language of tuition** Module is presented in English

**Department** Informatics

**Period of presentation** Semester 1

### Module content

Database design: the relational model, structured query language (SQL), entity relationship modelling, normalisation, database development life cycle; practical introduction to database design. Databases: advanced entity relationship modelling and normalisation, object-oriented databases, database development life cycle, advanced practical database design.

## Informatics 225 (INF 225)

**Module credits** 14.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Natural and Agricultural Sciences

**Prerequisites** INF 112; AIM 101 or AIM 102 or AIM 111 and AIM 121

**Contact time** 1 lecture per week, 3 practicals per week

**Language of tuition** Module is presented in English

**Department** Informatics

**Period of presentation** Semester 2

### Module content

An overview of systems infrastructure and integration.

## Informatics 261 (INF 261)

**Module credits** 7.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Natural and Agricultural Sciences

**Prerequisites** INF 214

**Contact time** 1 lecture per week, 1 practical per week

**Language of tuition** Module is presented in English

**Department** Informatics

**Period of presentation** Semester 2

### Module content

Database management: transaction management, concurrent processes, recovery, database administration: new developments: distributed databases, client-server databases: practical implementation of databases.

## Informatics 264 (INF 264)

**Module credits** 8.00





**Prerequisites** INF 112, AIM 101 or AIM 102 or AIM 111 and AIM 121

**Contact time** 2 practicals per week

**Language of tuition** Module is presented in English

**Department** Informatics

**Period of presentation** Semester 1

#### Module content

Application of spreadsheets and query languages in an accounting environment.

### Informatics 271 (INF 271)

**Module credits** 14.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology

**Prerequisites** AIM 101 or AIM 102 or AIM 111 and AIM 121, INF 164, INF 171

**Contact time** 1 discussion class per week, 1 lecture per week, 1 practical per week

**Language of tuition** Module is presented in English

**Department** Informatics

**Period of presentation** Year

#### Module content

Systems analysis. Systems design: construction; application architecture; input design; output design; interface design; internal controls; program design; object design; project management; system implementation; use of computer-aided development tools.

### Informatics 272 (INF 272)

**Module credits** 14.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Natural and Agricultural Sciences

**Prerequisites** AIM 101 or AIM 102 or AIM 111 and AIM 121, INF 164 and INF 171, Regulation IT.3(g)

**Contact time** 1 lecture per week, 2 practicals per week

**Language of tuition** Module is presented in English

**Department** Informatics

**Period of presentation** Year

#### Module content

Advanced programming.

### Introduction to agricultural economics 210 (LEK 210)

**Module credits** 12.00



**Service modules** Faculty of Economic and Management Sciences

**Prerequisites** No prerequisites.

**Contact time** 3 lectures per week

**Language of tuition** Module is presented in English

**Department** Agricultural Economics Extension and Rural Develo

**Period of presentation** Semester 1

### Module content

Introduction to financial management in agriculture: Farm management and agricultural finance, farm management information; analysis and interpretation of farm financial statements; risk and farm planning. Budgets: partial, break-even, enterprise, total, cash flow and capital budgets. Time value of money. Introduction to production and resource use: the agricultural production function, total physical product curve, marginal physical product curve, average physical product curve, stages of production. Assessing short-term business costs; Economics of short-term decisions. Economics of input substitution: Least-cost use of inputs for a given output, short-term least-cost input use, effects of input price changes. Least-cost input use for a given budget. Economics of product substitution. Product combinations for maximum profit. Economics of crop and animal production.

## Agricultural economics 220 (LEK 220)

**Module credits** 12.00

**Service modules** Faculty of Economic and Management Sciences

**Prerequisites** No prerequisites.

**Contact time** 3 lectures per week

**Language of tuition** Module is presented in English

**Department** Agricultural Economics Extension and Rural Develo

**Period of presentation** Semester 2

### Module content

The agribusiness system; the unique characteristics of agricultural products; marketing functions and costs; market structure; historical evolution of agricultural marketing in South Africa. Marketing environment and price analysis in agriculture: Introduction to supply and demand analysis. Marketing plan and strategies for agricultural commodities; market analysis; product management; distribution channels for agricultural commodities, the agricultural supply chain, the agricultural futures market.

## Linear algebra 211 (WTW 211)

**Module credits** 12.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Economic and Management Sciences

**Prerequisites** WTW 124

**Contact time** 1 tutorial per week, 2 lectures per week



**Language of tuition** Module is presented in English

**Department** Mathematics and Applied Mathematics

**Period of presentation** Semester 1

### Module content

This is an introduction to linear algebra on  $\mathbb{R}^n$ . Matrices and linear equations, linear combinations and spans, linear independence, subspaces, basis and dimension, eigenvalues, eigenvectors, similarity and diagonalisation of matrices, linear transformations.

## Calculus 218 (WTW 218)

**Module credits** 12.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Economic and Management Sciences

**Prerequisites** WTW 114 and WTW 124

**Contact time** 1 tutorial per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Mathematics and Applied Mathematics

**Period of presentation** Semester 1

### Module content

Calculus of multivariable functions, directional derivatives. Extrema and Lagrange multipliers. Multiple integrals, polar, cylindrical and spherical coordinates.

## Analysis 220 (WTW 220)

**Module credits** 12.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Economic and Management Sciences

**Prerequisites** WTW 114 and WTW 124, WTW 211 and WTW 218

**Contact time** 1 tutorial per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Mathematics and Applied Mathematics

**Period of presentation** Semester 2



## Module content

\*This module is recommended as an elective only for students who intend to enrol for WTW 310 and/or WTW 320. Students will not be credited for more than one of the following modules for their degree: WTW 220 and WTW 224.

Properties of real numbers. Analysis of sequences and series of real numbers. Power series and theorems of convergence. The Bolzano-Weierstrass theorem. The intermediate value theorem and analysis of real-valued functions on an interval. The Riemann integral: Existence and properties of the interval.

## Linear algebra 221 (WTW 221)

**Module credits** 12.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Economic and Management Sciences

**Prerequisites** WTW 211 and WTW 218

**Contact time** 1 tutorial per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Mathematics and Applied Mathematics

**Period of presentation** Semester 2

## Module content

Abstract vector spaces, change of basis, matrix representation of linear transformations, orthogonality, diagonalisability of symmetric matrices, some applications.

## Vector analysis 248 (WTW 248)

**Module credits** 12.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education

**Prerequisites** WTW 218

**Contact time** 1 tutorial per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Mathematics and Applied Mathematics

**Period of presentation** Semester 2

## Module content

Vectors and geometry. Calculus of vector functions with applications to differential geometry, kinematics and dynamics. Vector analysis, including vector fields, line integrals of scalar and vector fields, conservative vector fields, surfaces and surface integrals, the Theorems of Green, Gauss and Stokes with applications.

## Differential equations 264 (WTW 264)

**Module credits** 12.00



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<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences
<b>Prerequisites</b>	WTW 114 and WTW 124
<b>Contact time</b>	1 tutorial per week, 2 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Mathematics and Applied Mathematics
<b>Period of presentation</b>	Semester 2

**Module content**

\*Students will not be credited for both WTW 162 and WTW 264 or both WTW 264 and WTW 286 for their degree.

Theory and solution methods for ordinary differential equations and initial value problems: separable and linear first order equations, linear equations of higher order, systems of linear equations. Laplace transform.



## Curriculum: Final year

Minimum credits: 132

### Core modules

#### Statistics 310 (STK 310)

**Module credits** 25.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Humanities  
Faculty of Natural and Agricultural Sciences

**Prerequisites** STK 210, STK 220

**Contact time** 1 practical per week, 3 lectures per week

**Language of tuition** Module is presented in English

**Department** Statistics

**Period of presentation** Semester 1

#### Module content

Supervised learning. Linear and non-linear regression. Ordinary least squares and maximum likelihood estimation. Violations of the assumptions, residual analysis. Cross validation. Statistical inference. Bootstrap inference. Supporting mathematical concepts. Statistical concepts are demonstrated and interpreted through practical coding and simulation within a data science framework.

#### Statistics 320 (STK 320)

**Module credits** 25.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Economic and Management Sciences  
Faculty of Natural and Agricultural Sciences

**Prerequisites** STK 210, STK 220 or WST 211, WST 221

**Contact time** 1 practical per week, 3 lectures per week

**Language of tuition** Module is presented in English

**Department** Statistics

**Period of presentation** Semester 2

#### Module content

Stationary and non-stationary univariate time series. Properties of ARIMA processes. Identification, estimation and diagnostic testing of a time series models. Forecasting. Multivariate time series. Supervised learning: introduction to generalised linear models. Modelling of binary response variables, logistic regression. Supporting mathematical concepts. Statistical concepts are demonstrated and interpreted through practical coding and simulation within a data science framework.



## The science of data analytics 353 (STK 353)

<b>Module credits</b>	25.00
<b>Service modules</b>	Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	STK 210, STK 220, WST 212 or WST 211, WST 221, WST 212
<b>Contact time</b>	1 practical per week, 3 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Statistics
<b>Period of presentation</b>	Semester 2

### Module content

Data exploration. Data wrangling. Statistical coding. Algorithmic thinking. Sampling: basic techniques in probability, non-probability, and resampling methods. Text mining and analytics. Machine learning: classification and clustering. Statistical concepts are demonstrated and interpreted through practical coding and simulation within a data science framework.

## Multivariate analysis 311 (WST 311)

<b>Module credits</b>	18.00
<b>Service modules</b>	Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	WST 211, WST 221, WTW 211 GS and WTW 218 GS
<b>Contact time</b>	1 practical per week, 2 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Statistics
<b>Period of presentation</b>	Semester 1

### Module content

Multivariate statistical distributions: Moments of a distribution, moment generating functions, independence. Multivariate normal distribution: Conditional distributions, partial and multiple correlations. Distribution of quadratic forms in normal variables. Multivariate normal samples: Estimation of the mean vector and covariance matrix, estimation of correlation coefficients, distribution of the sample mean, sample covariance matrix. Principal component analysis. The linear model: Models of full rank, least squares estimators, test of hypotheses. The generalised linear model: Exponential family mean and variance, link functions, deviance and residual analysis, test statistics, log-linear and logit models. Practical applications: Practical statistical modelling and analysis using statistical computer packages and interpretation of the output.

## Stochastic processes 312 (WST 312)

<b>Module credits</b>	18.00
<b>Service modules</b>	Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	WST 211, WST 221, WTW 211 GS and WTW 218 GS



**Contact time** 1 practical per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Statistics

**Period of presentation** Semester 1

### Module content

Definition of a stochastic process. Stationarity. Covariance stationary. Markov property. Random walk. Brownian motion. Markov chains. Chapman-Kolmogorov equations. Recurrent and transient states. First passage time. Occupation times. Markov jump processes. Poisson process. Birth and death processes. Structures of processes. Structure of the time-homogeneous Markov jump process. Applications in insurance. Practical statistical modelling, analysis and simulation using statistical computer packages and the interpretation of the output.

## Time-series analysis 321 (WST 321)

**Module credits** 18.00

**Service modules** Faculty of Economic and Management Sciences  
Faculty of Natural and Agricultural Sciences

**Prerequisites** WST 211, WST 221, WTW 211 GS and WTW 218 GS

**Contact time** 1 practical per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Statistics

**Period of presentation** Semester 2

### Module content

**Note: Only one of the modules WST 321 or STK 320 may be included in any study programme.**

Stationary and non-stationary univariate time-series. Properties of autoregressive moving average (ARMA) and autoregressive integrated moving average (ARIMA) processes. Identification, estimation and diagnostic testing of a time-series model. Forecasting. Multivariate time-series. Practical statistical modelling and analysis using statistical computer packages, including that of social responsibility phenomena.

## Elective modules

### Economics 310 (EKN 310)

**Module credits** 20.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Humanities  
Faculty of Natural and Agricultural Sciences

**Prerequisites** EKN 214, EKN 234 or EKN 224, EKN 244

**Contact time** 1 discussion class per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Economics





**Period of presentation** Semester 1

**Module content**

Public finance

Role of government in the economy. Welfare economics and theory of optimality. Ways of correcting market failures. Government expenditure theories, models and programmes. Government revenue. Models on taxation, effects of taxation on the economy. Assessment of taxation from an optimality and efficiency point of view. South African perspective on public finance.

**Economics 314 (EKN 314)**

**Module credits** 20.00

**Service modules** Faculty of Natural and Agricultural Sciences

**Prerequisites** EKN 234, EKN 244

**Contact time** 3 lectures per week

**Language of tuition** Module is presented in English

**Department** Economics

**Period of presentation** Semester 1

**Module content**

International trade/finance

International economic insight is provided into international economic relations and history, theory of international trade, international capital movements, international trade politics, economic and customs unions and other forms or regional cooperation and integration, international monetary relations, foreign exchange markets, exchange rate issues and the balance of payments, as well as open economy macroeconomic issues.

**Economics 320 (EKN 320)**

**Module credits** 20.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Humanities  
Faculty of Natural and Agricultural Sciences

**Prerequisites** EKN 310 GS

**Contact time** 1 discussion class per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Economics

**Period of presentation** Semester 2



## Module content

Economic analyses

Identification, collection and interpretation process of relevant economic data; the national accounts (i.e. income and production accounts, the national financial account, the balance of payments and input-output tables); economic growth; inflation; employment, unemployment, wages, productivity and income distribution; business cycles; financial indicators; fiscal indicators; social indicators; international comparisons; relationships between economic time series - regression analysis; long-term future studies and scenario analysis; overall assessment of the South African economy from 1994 onwards.

## Economics 325 (EKN 325)

**Module credits** 20.00

**Service modules** Faculty of Humanities  
Faculty of Natural and Agricultural Sciences

**Prerequisites** EKN 214, EKN 234

**Contact time** 1 discussion class per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Economics

**Period of presentation** Semester 2

## Module content

Economic policy and development: Capita select

The course provides an introduction to growth economics and also to some topics on development economics. Firstly, historical evidence is covered and then the canonical Solow growth model and some of its empirical applications (human capital and convergence). Secondly, the new growth theory (the AK and the Romer models of endogenous growth) are covered. Some of the development topics to be covered include technology transfer, social infrastructure and natural resources.

## Financial accounting 311 (FRK 311)

**Module credits** 20.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology

**Prerequisites** FRK 211, 221 and INF 281

**Contact time** 4 lectures per week

**Language of tuition** Module is presented in English

**Department** Accounting

**Period of presentation** Semester 1



## Module content

Preparation and presentation of company annual financial statements in compliance with the requirements of International Financial Reporting Standards (IFRS) relating to the following: income taxes; property, plant and equipment; impairment; non-current assets held for sale; intangible assets; investment property; borrowing costs; leases; accounting policies; changes in accounting estimates and errors; segment reporting; certain aspects of financial instruments.

## Financial accounting 321 (FRK 321)

**Module credits** 20.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology

**Prerequisites** FRK 311 GS and INF 281

**Contact time** 4 lectures per week

**Language of tuition** Module is presented in English

**Department** Accounting

**Period of presentation** Semester 2

## Module content

Preparation and presentation of company annual financial statements in compliance with the requirements of International Financial Reporting Standards (IFRS) relating to the following: the effects of changes in foreign exchange rates; earnings per share; related party disclosure; associates. Complex consolidation issues, including intra-group transactions; dividends; preference shares; revaluations; horizontal, vertical and mixed groups; insolvent subsidiaries; change of interest; consolidated cash flow statement.

## Survival models 382 (IAS 382)

**Module credits** 18.00

**Service modules** Faculty of Economic and Management Sciences

**Prerequisites** IAS 221 60%, IAS 282 60%, WST 211, WST 221, WTW 211, WTW 218

**Contact time** 1 practical per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Actuarial Science

**Period of presentation** Semester 1

## Module content

Survival models and the life table, estimating the lifetime distribution, proportional hazard models, the binomial and Poisson models, exposed to risk, graduation and statistical tests, methods of graduation.

## Agricultural economics 310 (LEK 310)

**Module credits** 12.00

**Service modules** Faculty of Economic and Management Sciences

**Prerequisites** LEK 210 GS and EKN 110 GS



<b>Contact time</b>	3 lectures per week
<b>Language of tuition</b>	Afrikaans and English are used in one class
<b>Department</b>	Agricultural Economics Extension and Rural Develo
<b>Period of presentation</b>	Semester 1

#### Module content

Historical evolution of South African agricultural policy. Agriculture and the state: reasons for government intervention. Theoretical aspects of agricultural policy. Introduction to agricultural policy analysis. Welfare principles, pareto optimality. Macroeconomic policy and the agricultural sector. International agricultural trade.

### Agricultural economics 320 (LEK 320)

<b>Module credits</b>	16.00
<b>Service modules</b>	Faculty of Economic and Management Sciences
<b>Prerequisites</b>	LEK 210 GS and LEK 220 GS.
<b>Contact time</b>	2 practicals per week, 3 lectures per week
<b>Language of tuition</b>	Afrikaans and English are used in one class
<b>Department</b>	Agricultural Economics Extension and Rural Develo
<b>Period of presentation</b>	Semester 2

#### Module content

The modern food and agribusiness system. Key drivers in the global context. Whole farm planning and budget development The financial analysis of farm financial, financial modelling, the financing decision: capital acquisition, creditworthiness, different capital sources, capital structures. The investment decision and working capital management. Value chains in agribusiness. Risk management. Strategic management and marketing principles in agribusiness. Operational management and human resources management. Business planning for agribusiness.

### Actuarial statistics 322 (WST 322)

<b>Module credits</b>	18.00
<b>Service modules</b>	Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	WST 211, WST 221, WTW 211 GS and WTW 218 GS
<b>Contact time</b>	1 practical per week, 2 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Statistics
<b>Period of presentation</b>	Semester 2

#### Module content

Bayes estimation. Loss distributions. Reinsurance. Risk models. Ruin theory. Credibility theory. Extreme value theory. Copulas. Practical statistical modelling and analysis using statistical computer packages.



## Analysis 310 (WTW 310)

**Module credits** 18.00

**Service modules** Faculty of Education  
Faculty of Economic and Management Sciences  
Faculty of Humanities

**Prerequisites** WTW 220

**Contact time** 1 tutorial per week, 2 lectures per week

**Language of tuition** Afrikaans and English are used in one class

**Department** Mathematics and Applied Mathematics

**Period of presentation** Semester 1

### Module content

Topology of finite dimensional spaces: Open and closed sets, compactness, connectedness and completeness. Theorems of Bolzano-Weierstrass and Heine-Borel. Properties of continuous functions and applications. Integration theory for functions of one real variable. Sequences of functions.

## Complex analysis 320 (WTW 320)

**Module credits** 18.00

**Service modules** Faculty of Education

**Prerequisites** WTW 218 and WTW 220

**Contact time** 1 tutorial per week, 2 lectures per week

**Language of tuition** Afrikaans and English are used in one class

**Department** Mathematics and Applied Mathematics

**Period of presentation** Semester 2

### Module content

Series of functions, power series and Taylor series. Complex functions, Cauchy- Riemann equations, Cauchy's theorem and integral formulas. Laurent series, residue theorem and calculation of real integrals using residues.

## Financial engineering 354 (WTW 354)

**Module credits** 18.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Economic and Management Sciences

**Prerequisites** WST 211, WTW 211 and WTW 218

**Contact time** 1 tutorial per week, 2 lectures per week

**Language of tuition** Afrikaans and English are used in one class

**Department** Mathematics and Applied Mathematics

**Period of presentation** Semester 1



### Module content

Mean variance portfolio theory. Market equilibrium models such as the capital asset pricing model. Factor models and arbitrage pricing theory. Measures of investment risk. Efficient market hypothesis. Stochastic models of security prices

## Algebra 381 (WTW 381)

**Module credits** 18.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Economic and Management Sciences  
Faculty of Humanities

**Prerequisites** WTW 114 and WTW 211

**Contact time** 1 tutorial per week, 2 lectures per week

**Language of tuition** Afrikaans and English are used in one class

**Department** Mathematics and Applied Mathematics

**Period of presentation** Semester 1

### Module content

Group theory: Definition, examples, elementary properties, subgroups, permutation groups, isomorphism, order, cyclic groups, homomorphisms, factor groups. Ring theory: Definition, examples, elementary properties, ideals, homomorphisms, factor rings, polynomial rings, factorisation of polynomials. Field extensions, applications to straight-edge and compass constructions.

## Dynamical systems 382 (WTW 382)

**Module credits** 18.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Economic and Management Sciences

**Prerequisites** WTW 218 and WTW 286/264

**Contact time** 1 tutorial per week, 2 lectures per week

**Language of tuition** Afrikaans and English are used in one class

**Department** Mathematics and Applied Mathematics

**Period of presentation** Semester 1

### Module content

Matrix exponential function: homogeneous and non-homogeneous linear systems of differential equations. Qualitative analysis of systems: phase portraits, stability, linearisation, energy method and Liapunov's method. Introduction to chaotic systems. Application to real life problems.

## Numerical analysis 383 (WTW 383)

**Module credits** 18.00



<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences Faculty of Humanities
<b>Prerequisites</b>	WTW 114, WTW 123 WTW 124 and WTW 211
<b>Contact time</b>	1 practical per week, 2 lectures per week
<b>Language of tuition</b>	Afrikaans and English are used in one class
<b>Department</b>	Mathematics and Applied Mathematics
<b>Period of presentation</b>	Semester 2

### Module content

Direct methods for the numerical solution of systems of linear equations, pivoting strategies. Iterative methods for solving systems of linear equations and eigenvalue problems. Iterative methods for solving systems of nonlinear equations. Introduction to optimization. Algorithms for the considered numerical methods are derived and implemented in computer programmes. Complexity of computation is investigated. Error estimates and convergence results are proved.

## Geometry 389 (WTW 389)

**Module credits** 18.00

<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities
<b>Prerequisites</b>	WTW 211
<b>Contact time</b>	1 tutorial per week, 2 lectures per week
<b>Language of tuition</b>	Afrikaans and English are used in one class
<b>Department</b>	Mathematics and Applied Mathematics
<b>Period of presentation</b>	Semester 2

### Module content

Axiomatic development of neutral, Euclidean and hyperbolic geometry. Using models of geometries to show that the parallel postulate is independent of the other postulates of Euclid.

The information published here is subject to change and may be amended after the publication of this information. The [General Regulations \(G Regulations\)](#) apply to all faculties of the University of Pretoria. It is expected of students to familiarise themselves well with these regulations as well as with the information contained in the [General Rules](#) section. Ignorance concerning these regulations and rules will not be accepted as an excuse for any transgression.